

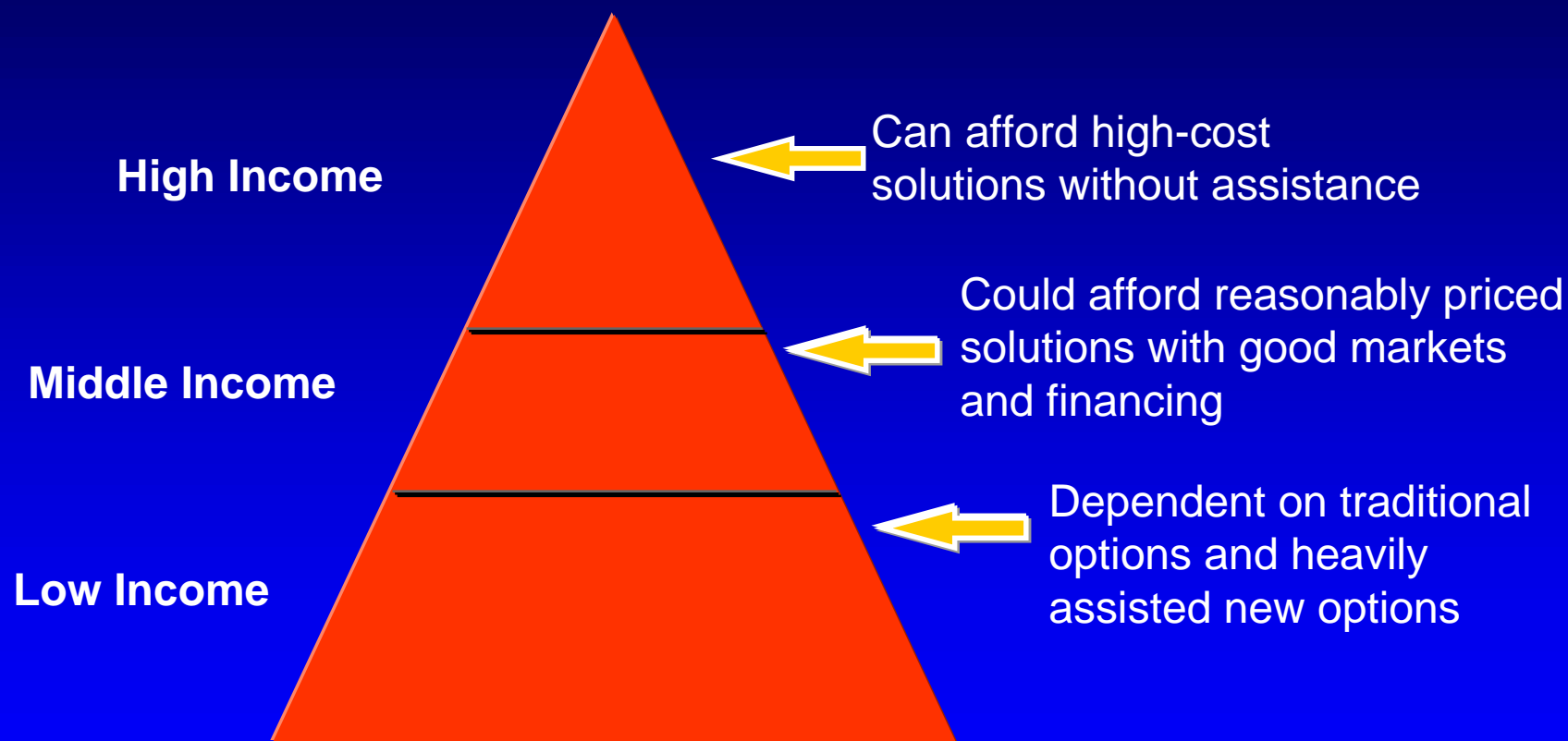
Lessons Learned with Rural Electrification Programs

*Implications for Large-Scale use of
Small-Scale Renewable Energy Systems*

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Rural Markets for Energy Services



Rural Electrification - the Challenge

- Worldwide there are 2 billion people without access to reliable electricity services
- The number of unelectrified households is growing faster than rural electrification can reach them
- Modern energy (electricity, clean fuels) is **essential for economic development, but it is not enough.**
- By itself, electricity supply rarely catalyzes economic development or social progress

Rural Electrification - the Challenge

- **Coinvestments** in priority social services (clean water, health services, telecommunications, education, ...) and in economically productive activities are essential for sustainable development
- In China, only 10% of the population lacks electricity services, but that is 100 million people!
- Unelectrified population in China is often remote, dispersed, and low income; increasingly served by small solar and wind electric equipment

Observations

- Virtually all rural electrification programs are heavily subsidized by central governments
- The subsidies benefit the relatively rich, and
- governments lack the funds to subsidize modern energy supply for the majority of the unelectrified populations
- Grid-based electrification is often uneconomic
 - Low energy consumption by end users
 - Dispersed populations
 - Challenging terrain

Lessons Learned - Rural Electricity

- Grid-based electrification
 - High capital cost (\$1,000+ per customer connection)
 - Utilities often must provide subsidized services, connect many communities (politics), but minimize financial losses.
 - High connection charges discourage customer hookup; only the richest of the poor get connected

Lessons Learned - Renewable Energy and Rural Electricity

- **Lesson:** Government cannot do it alone
(inadequate capital, poorly equipped for effective implementation, lack of business experience, and people expect governments to provide heavy subsidies)
- **Lesson:** Private sector cannot do it alone
(markets are expensive to enter and service without market aggregation mechanisms and assured customer base)
- **Implication:** The need for creative public/private partnerships

Rural Electrification Lessons (learned?)

- Bilateral development assistance programs often make matters worse:
 - Provide renewable energy equipment at highly subsidized prices through grants and concessional loans
 - Rarely (never?) provide support for establishment of local maintenance and service infrastructures
 - Kill local markets by creating false hope that all rural households can eventually get almost free energy or equipment if they wait for the (next) donor contribution
 - Benefit donor country industry much more than host country industry, markets, or users

Rural households are often willing and able to pay for basic energy services

- Rural energy surveys indicate significant fraction of rural households worldwide pay equivalent of \$5 - \$15 per month for kerosene, dry cell batteries, auto batteries, and battery charging
- But....
 - Most rural households cannot afford to purchase renewable energy units (PV/wind) without some financing, and
 - Most rural households cannot obtain financing, and
 - Even with financing, maintenance and repair are difficult (dealer support is often an illusion)

Lessons Learned - Renewable Energy and Rural Electricity

- Until recently, most rural applications of renewables have been photovoltaic home lighting systems (*China household biogas an exception*)
- **Lesson:** Lighting and entertainment / information, although highly desired, contributes little to economic development or community needs
- **Lesson:** Using decentralized energy for meaningful and sustainable rural development requires focus on *community services* and *economically productive uses*

Lessons Learned - Renewable Energy and Rural Electricity

- The sales model for PV equipment has serious limitations
 - Most customers require financing or leasing
 - Many companies sell inferior equipment to minimize costs to customers
 - Many companies do not or cannot service what they sell
- End-user financing problems (e.g. Zimbabwe)
 - Relatively few rural households can qualify
 - Lending institution will require repayment even if the RE system fails!

Requirements of a new approach to rural electricity services

- ◆ Serve **all** customers in a geographic area - build a *service territory*
- ◆ Use most appropriate renewable energy technology
- ◆ Meet **each** customer's priority energy requirements
- ◆ Charge customers **less than** what they now pay for inferior energy

Requirements of a new approach to rural electricity services

- ◆ Service **fees**, not kWh rates - sell energy services (market-driven)
- ◆ Provide customers with service **without technology risk or financial risk!**
- ◆ Use modular/transportable power systems
- ◆ Establish **local service infrastructure**
- ◆ Share capital costs (public/private partnerships)

Requirements of a new approach to rural electricity services

- Offer both AC and DC electricity services
- Electricity and thermal energy (cooking!)
- Business focus on large-scale replication in a region
- Serve households, community services (e.g., water supply, health, education), and enterprise

From RESCO to *RISE*

- RESCO - rural energy service company
- *RISE* - *Rural Infrastructure Services Company*
 - Sales and service for end-use equipment
 - Service contracts for non-energy equipment
 - Non-energy services including community clean water supply and telecommunications
 - Coinvestments in local enterprises that require energy services

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